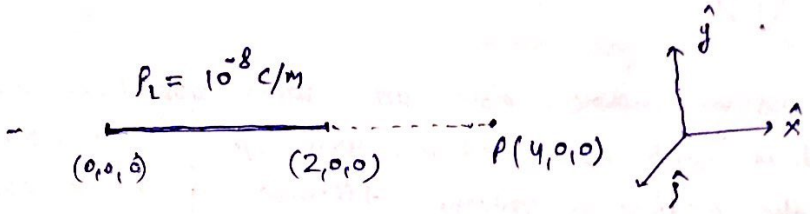
Electrostatics

DPP-6 Center for Engineering Studies

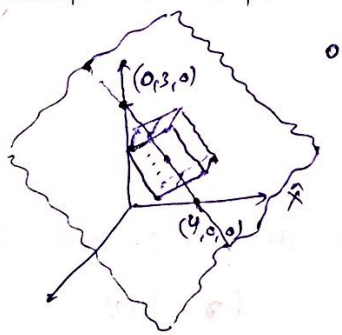
Q-1. Find electric field intensity at point P (4,0,0) due to a finite length uniform charge distribution as shown below



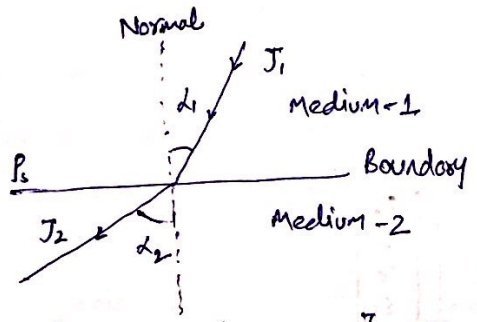
Q-2. A positive charge 2C is at the center of a spherical dielectric shell of an inner radius $R_i = 4$mm and outer radius $R_o = 6$ mm. Dielectric constant of the shell is 2.5. Find the surface charge density on the inner surface due to polarization ——— C/m^2

Q-3. In copper material whose conductive is $\sigma = 5.8 \times 10^7$ s/m and $\epsilon_r = 1$. If some charge density ρ_{vo} is placed at some point inside copper material. Find time in which 60% of charge density vanish from the interior point and appear at the surface. ——— $\times 10^{-19}$ sec.

Q-4. A dielectric interface is defined by $3x + 4y = 12$ is shown below origin lies in free space; where $\vec{E} = 2\hat{i} - 4\hat{j} + 7\hat{k}$. In other region $\epsilon_r = 2$. Find energy within a cube of side 2.5 m centre lies on the plane $3x + 4y = 12$ as shown Centre of cube is P(2, 1.5, 4)



Q-5.



Medium-1 be carbon and medium-2 is copper.

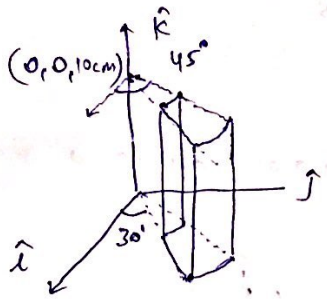
If $\alpha_2 = 89.8°$

Conductivity of copper is 5.7×10^7 υ/m

Conductivity of carbon is 3×10^4 υ/m

Find α_1 ——— degrees.

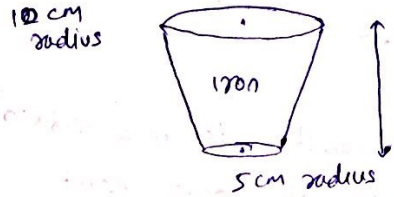
Q-6.



Two conducting plates of capacitor are at $r=10$ cm and $r=20$ cm. The medium between the plates is 2.5. Determine the capacitance between the plates.

Q-7. A parallel-plate capacitor whose plates are 10cm square and 0.2 cm apart contains a medium with $\epsilon_r = 2.5$ and $\sigma = 4\times10^{-5}$ S/m. To maintain a steady current through the medium a potential difference of 120V is applied between the plates. The resistance of the medium between the plates will be ____ KΩ

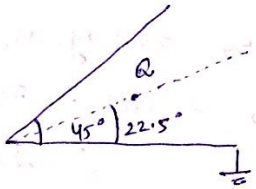
Q-8. A truncated circular cone is shown below is made of iron



resistivity of iron is 8.9×10^{-8} Ω.m.

find resistance of the cone between its flat ends ____ Ω

Q-9.



No. of image charges will be ____

Q-10. Given that $J = \frac{5e^{-10^4 t}}{r}\hat{r}$ A/m² at $t = 0.1$ msec find charge density ρ_v on that surface ____ C/m³ ($r = 2$m)

Q-11. for a medium

$$\begin{bmatrix} D_x \\ D_y \\ D_z \end{bmatrix} = \begin{bmatrix} 2\epsilon_0 & 0 & 0 \\ 0 & 2\epsilon_0 & 0 \\ 0 & 0 & 2\epsilon_0 \end{bmatrix} \begin{bmatrix} E_x \\ E_y \\ E_z \end{bmatrix}$$

which of the following statement is Not true

(a) $\nabla \cdot D = \rho_v$ (b) $\oint \bar{E}\cdot d\bar{s} = \frac{Q_{enclosed}}{2\epsilon_0}$ (c) $\oint \bar{D}\cdot d\bar{s} = Q_{enclosed}$

(d) $\oint \bar{E}\cdot d\bar{s} = \frac{Q_{enclosed}}{\epsilon_0}$